MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

BMT1014 – MANAGERIAL MATHEMATICS
(All sections / Groups)

15 OCTOBER 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages excluding the cover page.
2. Attempt ALL FOUR questions.
3. Write your answers in the Answer Booklet provided.
4. The mathematical formulae are attached at the end of this question paper.

Question 1 (20 marks)

a) Find the equation of a straight line that is perpendicular to $y = \frac{1}{4}x + 7$ and passes through a point (–2, 3).

(5 marks)

b) Suppose that a manufacturer will place on the market 80 units of a product when the price is RM 10 per unit and 100 units when the price is RM 12 per unit. Find the supply equation for the product assuming that price, y, and quantity, x, are linearly related.

(4 marks)

c) A rock band has gained much popularity across the country. They bought a bus to travel to their destinations. The purchase price was £185,000. The value of the bus will depreciate linearly over 10 years and will then have a scrap value of £75,000.

i) What is the rate of depreciation? (2 marks)

ii) Write a linear function that describes the value of the bus at the end of the t^{th} year of use, where $0 \leq t \leq 10$.

(1 mark)

iii) When will the bus be worth $130,000? (2 marks)

d) A watch manufacturer experiences fixed daily cost of $ 500 and a variable cost of $ 7 for each watch produced. The selling price is $ 8 per watch.

i) Find the cost, revenue and profit functions. (3 marks)

ii) Find the quantity and revenue when the manufacturer breaks even. (3 marks)

Continued...

Question 2 (20 marks)

A book publisher produces two types of books: children's storybook and biography. Both books require editing and printing by the publisher. The number of hours needed for editing and printing are indicated in the following table.

	Storybook	**Biography**
Editing	3 hours	4 hours
Printing	2 hours	6 hours

The employee hours available for editing and printing are 1150 and 1100 hours, respectively. The profit made on storybooks is RM 15 per unit and the profit made on biography is RM 30 per unit.

a) Formulate the linear programming (LP) problem, assuming that the publisher wants to maximize the profit.

(5 marks)

b) Solve the LP problem formulated in 2(a). (14 marks)

c) How many units of each books should the publisher produce in order to maximize the profit?

(1 mark)

Question 3 (25 marks)

a) Alex borrowed $6,300 from his father to buy a car. He repaid him after 9 months with interest of 7% per year. Find the total amount he repaid.

(3 marks)

b) Kira made an initial deposit of RM 2,600 into a savings account. Assuming an interest rate of 5% compounded quarterly, how much will the account be worth in 9 years?

(4 marks)

c) Find the present value of RM 5,000 due in 3 years if the interest rate is 6.75% compounded monthly.

(5 marks)

d) Suppose a person deposits RM 1,280 in a savings account at the end of every six months. What is the value of the account at the end of five years if interest is at a rate of 10% compounded semiannually?

(5 marks)

Continued...

e) A \$5000 loan is to be repaid over three years by equal payments due at the end of every quarter. If interest is at the rate of 20% compounded quarterly, determine:

   i) the quarterly payment. (5 marks)

   ii) the total interest paid. (3 marks)

Question 4 (35 marks)

a) Find the derivative for each function below:

   i) $y = (x^2 + x + 5)(2x - 3)$ (8 marks)

   ii) $y = (4x^2 - 7x + 15)^3$ (3 marks)

b) Evaluate the following integrals:

   i) $\int \left(5 + \frac{2}{7}x^2 - \frac{8}{3}x^4\right)dx$ (4 marks)

   ii) $\int 9x^2(3x^3 + 7)^5 dx$ by using the substitution method. (5 marks)

c) A television manufacturing company makes two types of TV's. The cost (in dollars) of producing x units of type A and y units of type B is given by the function:

$$C(x, y) = 2x^2 + 6y^2 - 80x - 480y + 12000.$$

   i) Find the first partial derivatives. (4 marks)

   ii) How many units of type A and type B televisions should the company produce to minimize its cost?

   (9 marks)

   iii) Compute the minimum cost at optimal production level. (2 marks)

End of Questions.

FORMULAE

1. Linear Equations

(i) Slope of a line, $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

(ii) Point-slope form, $y - y_1 = m(x - x_1)$

(iii) Slope-intercept form, $y = mx + b$ (where m = slope, b = y-intercept)

(iv) General form, $Ax + By + C = 0$

2. Mathematics of Finance

a) Simple Interest

(i) Interest, $I = Prt$

(ii) Accumulated amount, $A = P(1 + rt)$

Where P = principal, r = interest rate, t = number of years

b) Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Where $i = \dfrac{r}{m}$, $n = mt$, and m = number of conversion periods per year

c) Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

d) Annuities

Notations: $i = \dfrac{r}{m}$ and $n = mt$

(i) Future value of an annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

Where S = future value of ordinary annuity of n payments of R dollars periodic payment

(ii) Present value of an annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

Where P = present value of ordinary annuity of n payments of R dollars periodic payment

e) Sinking Fund and Amortization Notations: $i = \frac{r}{m}$ and $n = mt$	
(i) Sinking Fund formula $$R = \frac{Si}{(1+i)^n - 1}$$ Where R = periodic payment required to accumulate S dollars over n periods	(ii) Amortization formula $$R = \frac{Pi}{1-(1+i)^{-n}}$$ Where R = periodic payment on a loan of P dollars to be amortized over n periods

3. Rules of Differentiation

a) Derivative of a constant: If $f(x)$ is a constant, then $f'(x) = 0$

b) Power rule : If $f(x)$ is x^n, then $f'(x) = nx^{n-1}$

c) Constant multiple rule: Derive $cf(x) = cf'(x)$ (c is a constant)

d) Sum rule: Derive $f(x) \pm g(x) = f'(x) \pm g'(x)$

e) Product rule: If $f(x) = u \times v$, then $f'(x) = u\frac{dv}{dx} + v\frac{du}{dx}$

f) Quotient rule: If $f(x) = \frac{u}{v}$, then $f'(x) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{[v]^2}$

g) Chain rule: Derive $g[f(x)] = g'[f(x)]f'(x)$

h) General power rule: Derive $[f(x)]^n = n[f(x)]^{n-1} f'(x)$

i) Exponential function: Derive $e^x = e^x$

Derive $(e^u) = e^u [u'(x)]$

j) Logarithmic function: Derive $\ln x = \frac{1}{x}$

Derive $(\ln u(x)) = \left(\frac{1}{u(x)}\right)[u'(x)]$

4. Integration

a) **Basic Rules of Integration**

(i) Indefinite integral of a constant: $\int k \; du = ku + C$

(ii) Power rule: $\int u^n du = \dfrac{u^{n+1}}{n+1} + C$

(iii) Constant multiple rule: $\int kf(u) \; du = k\int f(u) \; du$ where k is a constant

(iv) Sum rule: $\int [f(u) \pm g(u)] \; du = \int f(u)du + \int g(u)du$

(v) Exponential function: $\int e^u du = e^u + C$

(vi) Logarithmic function: $\int \left(\dfrac{1}{u}\right) du = \ln u + C$

b) **Definite Integrals**

(i) **The fundamental Theorem of Calculus**

Let f be continuous on [a,b], then,

$\int_a^b f(x) \; dx = F(b) - F(a)$ where F is any antiderivative of f; that is $F'(x) = f(x)$

(ii) **Area between two curves**

Let f and g be continuous functions such that $f(x) \geq g(x)$ on the interval $[a,b]$. Then the area of the region bounded on $[a,b]$ is given by $\int_a^b [f(x) - g(x)] \; dx$.

5. Calculus of Several Variables

Determining Relative Extrema

$$D(x,y) = f_{xx} f_{yy} - (f_{xy})^2$$

If D > 0 and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If D > 0 and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If D < 0, (x, y) is neither maximum nor minimum.
If D = 0, the test is inconclusive.